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EXAMINER	
AMIN, JWALANT B	

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2628	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/691,396	HIGGINS	
	Examiner	Art Unit	
	Jwalant Amin	2628	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *07 July 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-21 and 30-33* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-21 and 30-33* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *07 July 2007* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's arguments, see pages 14-29 of applicant's remarks, filed 7/7/07, with respect to the rejection(s) of claim(s) 1-21 and 30-33 under 35 U.S.C. 103(a) have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Childs et al. (GB 2282928; hereinafter Childs), in view of Yanagawa et al. (Us 5694186; hereinafter Yanagawa), in view of Ito (US 4989079), in view of Herbert et al. (US 2004/0111435; hereinafter Herbert), and in view of Kasson (US 5,450,216).

2. Regarding claims 1 and 11, the applicant argues the limitations of "dividing the target color space into regions" (see pg. 15-16 of applicant's remarks). The applicant further argues that with the motivation for combining of the Childs and Yanagawa references (see pg. 16-17 of applicant's remarks).

3. However, the examiner interprets that Childs teaches a method for converting source color points in source image data from a source color space to a target color space, said source color space defined by a combination of N source primary color points, wherein N is an integer (Fig. 4, pg. 12 paragraph 3; four display drive signals correspond to target color space where four corresponds to N+1; three primary transmission system corresponds to source color space where three corresponds to N; Rs, Gs and Bs corresponds to three primary color points of source color space), the method comprising for the target color space, defining a set of at least N+1 target primaries in which to render said source color points as a combination of said target

primaries (Fig. 5, pg. 17 last paragraph; four display colour primaries R_d, G_{1d}, G_{2d}, B_d corresponds to defining a set of N+1 primaries; point D65/colours inside the triangles corresponds to color point rendered as a combination of said primaries); said at least N+1 primaries forming the boundary of the target color space (Fig. 5; R_d, G_{1d}, G_{2d}, B_d form the boundary of the target color space formed by these colors); defining an interior color point (D65, Fig. 5) positioned in the interior of the boundary of said target color space; dividing said target color space into a set of regions that are bounded by at least two of the at least N+1 target primaries and by said interior color point (Fig. 5, pg. 8 paragraph 4; dissecting the colour gamut of display corresponds to dividing said target color space; triangles corresponds to regions; formed by sets of three of the display primaries corresponds bounded by at least two of the N+1 primaries; Fig. 5 shows that the triangles are formed comprising two primaries and an imaginary primary G_{3d}, but do not include the interior color point; however it shows how to divide a triangle into regions using two of at least N+1 primaries and a third color point which resides on the boundary of the target color space); calculating a solution matrix for each said region (pg. 9 last paragraph, pg. 10 3rd paragraph; take sets of three of the display primaries and form a 3 by 3 display matrix corresponds to forming solution matrices for each said region; the separate solutions ... each solution produces drive signals corresponds to calculating solution matrices); and for a given source color point in said source color space, selecting one of said solution matrices for rendering said source color point in said target color space (Fig. 3, Fig. 5, pg. 10 1st paragraph, pg. 12 4th paragraph; D65/white point corresponds to any given color point; Rs, Gs and Bs system primary

signals correspond to source color space; a logic unit ... selects a set for which each pixel has only positive output signals and these respective matrix outputs are input to switches controlled by the logic unit correspond to selecting one of the solution matrices for rendering said source color point with said target primaries), and computing an output color point using said source color point and said selected solution matrix (fig. 4, output from the matrix units corresponds to the output color points).

Although Childs teaches the claimed limitations as stated above, Childs does not explicitly disclose that the color space is divided into regions at least two primaries and the interior color point. However, Yanagawa teaches to a triangle with vertices at the points R', G' and B', which is the gamut of color of reproducible colors, shift toward the point W' (Fig. 2, col. 5 lines 60-67, col. 6 lines 1-12; Fig. 2 shows the primary colors R', G' and B' shift towards the point white W', which is the interior point of triangle formed by R'G'B').

Childs teaches that overlapping triangles can be used to avoid noise and that it is possible to calculate an analysis for a triangle that uses two real primaries and one synthetic primary, made by mixing two others (pg. 8 last three paragraphs and pg. 9 first paragraph). Yanagawa teaches the importance of white point, which is included in the triangle R'G'B', so that when R'G'B' is shifted to the said white point, it produces a narrow gamut of reproducible colors (col. 6 lines 1-12). Therefore, a person of ordinary skill has good reason to pursue the option of forming more overlapping triangles as taught by Childs by using the white point by shifting those colors. If this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and

common sense. Therefore, it would have been obvious to one of ordinary skill in art at the time of present invention to try and pursue the known option forming more overlapping triangles using the white point, with a reasonable expectation of success.

4. Regarding claims 1 and 11, the applicant further argues that Childs teaches one of ordinary skill in art not to expect that dividing the color space using at least two primaries and an imaginary primary on the boundary of the color space works equally as well as when each triangular region includes the balance point (an interior point) of the display color space" (see pg. 18 of applicant's remarks).

5. However, the examiner interprets that Childs teaches any triad not containing the white point will produce a column in the display matrix containing only negative numbers, and the appropriate multiplier (1, m or n) is negative. This is only a mathematical problem, and does not render the problem insoluble (pgs. 8-9).

6. Regarding claims 1 and 11, the applicant argues that Yanagawa does not provide a teaching that is relevant to the color space conversion techniques disclosed in Childs (see pg. 20 of applicant's remarks).

7. In response to applicant's argument that Yanagawa is nonanalogous art, it has been held that a prior art reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the applicant was concerned, in order to be relied upon as a basis for rejection of the claimed invention. See *In re Oetiker*, 977 F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992).

In this case, Yanagawa is analogous to Childs as it teaches a triangle with vertices at the points R', G' and B', which is the gamut of color of reproducible colors,

shift toward the point W' (Fig. 2, col. 5 lines 60-67, col. 6 lines 1-12; Fig. 2 shows the primary colors R', G' and B' shift towards the point white W', which is the interior point of triangle formed by R'G'B'). Yanagawa teaches the importance of white point, which is included in the triangle R'G'B', so that when R'G'B' is shifted to the said white point, it produces a narrow gamut of reproducible colors (col. 6 lines 1-12).

Childs teaches that overlapping triangles can be used to avoid noise and that it is possible to calculate an analysis for a triangle that uses two real primaries and one synthetic primary, made by mixing two others (pg. 8 last three paragraphs and pg. 9 first paragraph).

Therefore, a person of ordinary skill has good reason to pursue the option of forming more overlapping triangles as taught by Childs by using the white point by shifting those colors. If this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense. Therefore, it would have been obvious to one of ordinary skill in art at the time of present invention to try and pursue the known option forming more overlapping triangles using the white point, with a reasonable expectation of success.

8. Regarding claims 1 and 11, the applicant further argues "even if a person of ordinary skill would have interpreted FIG. 2 as disclosing triangles bounded by an interior point, such a person of ordinary skill would not have been motivated to modify the triangular regions in Childs to be defined by at least two target primary color points and an interior color point on the basis of FIG. 2 in the Yanagawa reference or the

discussion therein of viewing angle problems in three-primary color LCD displays" (see pg. 20-21 of applicant's remarks).

9. However, the examiner interprets that Childs teaches that overlapping triangles can be used to avoid noise and that it is possible to calculate an analysis for a triangle that uses two real primaries and one synthetic primary, made by mixing two others (pg. 8 last three paragraphs and pg. 9 first paragraph). Yanagawa teaches the importance of white point, which is included in the triangle R'G'B', so that when R'G'B' is shifted to the said white point, it produces a narrow gamut of reproducible colors (col. 6 lines 1-12). Therefore, a person of ordinary skill has good reason to pursue the option of forming more overlapping triangles as taught by Childs by using the white point by shifting those colors. If this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense. Therefore, it would have been obvious to one of ordinary skill in art at the time of present invention to try and pursue the known option forming more overlapping triangles using the white point, with a reasonable expectation of success.

10. Regarding claims 3 and 13, applicant argues that the regions formed by Childs or the combination of Childs and Yanagawa, are not bounded by at least two of the at least N+l primaries and by interior color point D65 (see pg. 21 of applicant's remarks).

11. However, the examiner interprets that the combination of Childs and Yanagawa teaches to use the interior white point to form more overlapping triangles (please refer to the rejection of claim 1 below or the arguments above). Therefore, it is correct to interpret that the interior color point is the white point of the target color space.

12. Regarding claims 10 and 20, applicant argues that "a hue angle as taught by Ito is simply not needed to determine the appropriate conversion matrix". Applicant further argues that a person of ordinary skill would not use hue in the combination of Childs and Yanagawa because it would not uniquely select the appropriate conversion matrix to use to convert the input color to the output color (see pg. 23 of applicant's remarks).

13. In response to applicant's argument that Ito is nonanalogous art, it has been held that a prior art reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the applicant was concerned, in order to be relied upon as a basis for rejection of the claimed invention. See *In re Oetiker*, 977 F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992).

In this case, the examiner interprets that although Childs does not explicitly teach to determine the hue angle of said source color point and using hue angle to select the region in which said source color point resides, however, Yanagawa teaches to shift (shift is a form of transformation) R', G' and B' points in the gamut of reproducible colors. The colors in any of triangles R'G'W', R'B'W' and B'G'W' will also shift due to this transformation, changing the hue of those colors to avoid any discontinuities (Fig. 2, col. 5 lines 53-67, col. 6 lines 1-12). Therefore, it would have been obvious to one of ordinary skill in the art at the time of present invention to shift the colors in the gamut of reproducible colors as taught by Yanagawa and use it into the system of Childs because the degree of shifting the primary colors towards the white displayed in maximum brightness at a viewing angle can be a measure for determining an area of

uniform color in the color liquid crystal display device (col. 5 lines 53-67 and col. 6 lines 1-15).

Although, the combination of Childs and Yanagawa teach the claimed limitations as stated above, they do not explicitly teach to determine the hue angle of said source color point and using hue angle to select the region in which said source color point resides, and use the hue to determine the color correction parameters to avoid discontinuities due to transformation. However, Ito teaches to calculate the hue (hue angle) of a signal (source color point) on the basis of the density of ratio of three primaries, and based on the hue of the input signal (source color point) it is determined which of the six hue areas (regions) it belongs to (fig. 12, col. 16 lines 35-67, col. 17 lines 1-42). Ito further teaches to determine hue of RGB input colors for providing the color correction parameters (col. 4 line 1-26; the RGB colors of fig. 12 are analogous to the R'G'B' colors of Yanagawa's fig. 2). Therefore, it would have been obvious to one of ordinary skill in the art at the time of present invention to calculate hue of a color point to determine it's region of location as taught by Ito and apply it into the method of Childs and Yanagawa because calculating the hue on the basis of ratio of spectral densities improves color harmony at the boundary between hue areas (col. 16 lines 38-41).

The examiner interprets that though the hue may not be needed to determine the appropriate conversion matrix, it does improve color harmony at the boundary between hue areas as suggested above.

14. Regarding claims 4 and 14, applicant argues that Herbert does not teach "said interior color point is an off-white point of the target color space" (see pg. 25 of applicant's remarks).

15. Though the applicant has given his interpretation of Herbert's reference, the examiner does not agree with such an interpretation. The examiner further interprets that although the combination of Childs and Yanagawa do not explicitly teach that the interior point is an off-white point, Herbert teaches to use an off white point of a lamp's light as the whitest white point of that illuminant ([0025] lines 1-11). Therefore, it would have been obvious to one of ordinary skill in the art at the time of present invention to use an off white point as the white point as taught by Herbert into the system of Childs and Yanagawa because off white points of different illuminants serves as that illuminants white point by adjusting to that illuminant's surrounding environment ([0025] lines 5-11).

16. Regarding claim 21, the applicant argues "... this language teaches away from making the combination of Childs and Kasson" (see pg. 27 of applicant's remarks). Applicant further teaches that Kasson does not teach a multi-primary converter further configured to select said conversion matrix using the calculated hue angles (see pg. 28 of applicant's remarks).

17. In response to applicant's argument as stated above, the fact that applicant has recognized another teaching which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious.

18. Regarding claim 21, Childs teaches a system for converting source image data color points from a source color space to a target color space, wherein said source color space is defined by N source primary color points and said target color space is defined by at least at least N+1 target primary color points (pg. 12 4th paragraph), said system comprising input means for accepting source image data color points (pg. 12 4th paragraph; transmission system corresponds to input means); a multi-primary converter for image data values from N-primary source color space into image data values for rendering in the at least N+1 primary color space configured for converting said source image data color points from the N-primary source color space into image data values for the at least N+1 primary target color space using one of a plurality of conversion matrices (Fig. 4, pg. 12 4th paragraph; decoding circuit corresponds to multi-primary converter; three primary transmission system corresponds to source image data color points from the N-primary source color space; four primary display device corresponds to image data values for the at least N+1 primary target color space; matrix outputs corresponds to plurality of conversion matrices; matrix outputs are controlled by logic unit of the decoding circuit corresponds to multi-primary converter is further configured to select said conversion matrix). Childs further teaches to select the conversion matrix by determining in which region said source color point resides (Fig. 3, Fig. 5, pg. 10 1st paragraph, pg. 12 4th paragraph; a logic unit ... selects a set for which each pixel has only positive output signals correspond to determining which said region the color point lies in; if the triad of primaries ... display matrix is negative corresponds to point does not reside in that region).

Although Childs discloses all of the claimed limitations as stated above, he does not explicitly teach a hue calculator configured for calculating hue angles for the source image data color points, and a gamut converter configured for optionally fitting the gamut of the source color space to the gamut of said target color space using the calculated hue angles. However, Kasson teaches to compute the hue angle as the arctangent of the ratio of the two chrominance components (Fig. 5, col. 8 lines 58-68), and a gamut converter for optionally fitting (mapping) the gamut of the source color space (out-gamut points) to said target color space (device-dependent gamut) using the calculated hue angles (Fig. 5, col. 8 lines 32-37 and lines 58-68, col. 9 lines 48-65; Fig. 5 shows that the computed hue angles are used to while mapping from out-gamut points to the device-dependent gamut; Kasson teaches to use the hue angles for fitting the gamut of source color space to the target color space, although he does not teach to use the hue angles optionally, but if the hue angles were used optionally then the gamut converter would be fitting the source color space to the target color space with no difference between them, and there would have been no point of converter the source color space into a target color space if it were to remain the same. It would have been obvious to one of ordinary skill in the art at the time of present invention to use hue angles if they intended to change the source space to a target color space, different than the source color space). Therefore, it would have been obvious to one of ordinary skill in the art at the time of present invention to calculate and use hue angles for gamut mapping as taught by Kasson and apply it into the method of Childs because using hue

angles helps luminance variations at low spatial frequencies to which humans are relatively insensitive (col. 8 lines 52-56).

Although the combination of Childs and Kasson teach the claimed limitations as stated above, they do not explicitly teach using the calculated hue angles of the source color point to determine the region in which the source color point resides. However, Ito teaches to calculate the hue (hue angle) of a signal (source color point) on the basis of the density of ratio of three primaries, and based on the hue of the input signal (source color point) it is determined which of the six hue areas (regions) it belongs to (fig. 12, col. 16 lines 35-67, col. 17 lines 1-42; thus Ito teaches to determine the region of the point based on the hue; it should be noted here that Childs as stated teaches to select the conversion matrix by determining in which region said source color point resides using the multi-primary converter (Fig. 3, Fig. 5, pg. 10 1st paragraph, pg. 12 4th paragraph; a logic unit ... selects a set for which each pixel has only positive output signals correspond to determining which said region the color point lies in; if the triad of primaries ... display matrix is negative corresponds to point does not reside in that region)). Therefore, it would have been obvious to one of ordinary skill in the art at the time of present invention to calculate hue of a color point to determine it's region of location as taught by Ito and apply it into the method of Childs and Kasson because calculating the hue on the basis of ratio of spectral densities improves color harmony at the boundary between hue areas (col. 16 lines 38-41).

19. Regarding claim 32, the applicant argues that the language of claims 21 and 32 are different, and not necessary parallel, and asks to submit a clarification if the

applicant has made an incorrect assumption regarding the Ito reference (see pg. 29 of applicant's remarks).

20. However, the examiner has re-written the rejection to clarify the applicant's doubts. The examiner also states that Ito reference is very much a part of the rejection. Please see the rejection of claim 32 for details.

Claim Rejections - 35 USC § 103

21. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

22. Claims 1-3, 5-9 and 11-13, and 15-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Childs, and further in view of Yanagawa.

23. Regarding claims 1, Childs teaches a method for converting source color points in source image data from a source color space to a target color space, said source color space defined by a combination of N source primary color points, wherein N is an integer (Fig. 4, pg. 12 paragraph 3; four display drive signals correspond to target color space where four corresponds to N+1; three primary transmission system corresponds to source color space where three corresponds to N; Rs, Gs and Bs corresponds to three primary color points of source color space), the method comprising for the target color space, defining a set of at least N+1 target primaries in which to render said source color points as a combination of said target primaries (Fig. 5, pg. 17 last

paragraph; four display colour primaries R_d, G_{1d}, G_{2d}, B_d corresponds to defining a set of N+1 primaries; point D65/colours inside the triangles corresponds to color point rendered as a combination of said primaries); said at least N+1 primaries forming the boundary of the target color space (Fig. 5; R_d, G_{1d}, G_{2d}, B_d form the boundary of the target color space formed by these colors); defining an interior color point (D65, Fig. 5) positioned in the interior of the boundary of said target color space; dividing said target color space into a set of regions that are bounded by at least two of the at least N+1 target primaries and by said interior color point (Fig. 5, pg. 8 paragraph 4; dissecting the colour gamut of display corresponds to dividing said target color space; triangles corresponds to regions; formed by sets of three of the display primaries corresponds bounded by at least two of the N+1 primaries; Fig. 5 shows that the triangles are formed comprising two primaries and an imaginary primary G_{3d}, but do not include the interior color point; however it shows how to divide a triangle into regions using two of at least N+1 primaries and a third color point which resides on the boundary of the target color space); calculating a solution matrix for each said region (pg. 9 last paragraph, pg. 10 3rd paragraph; take sets of three of the display primaries and form a 3 by 3 display matrix corresponds to forming solution matrices for each said region; the separate solutions ... each solution produces drive signals corresponds to calculating solution matrices); and for a given source color point in said source color space, selecting one of said solution matrices for rendering said source color point in said target color space (Fig. 3, Fig. 5, pg. 10 1st paragraph, pg. 12 4th paragraph; D65/white point corresponds to any given color point; Rs, Gs and Bs system primary signals correspond to source

color space; a logic unit ... selects a set for which each pixel has only positive output signals and these respective matrix outputs are input to switches controlled by the logic unit correspond to selecting one of the solution matrices for rendering said source color point with said target primaries), and computing an output color point using said source color point and said selected solution matrix (fig. 4, output from the matrix units corresponds to the output color points).

Although Childs teaches the claimed limitations as stated above, Childs does not explicitly disclose that the color space is divided into regions at least two primaries and the interior color point. However, Yanagawa teaches to a triangle with vertices at the points R', G' and B', which is the gamut of color of reproducible colors, shift toward the point W' (Fig. 2, col. 5 lines 60-67, col. 6 lines 1-12; Fig. 2 shows the primary colors R', G' and B' shift towards the point white W', which is the interior point of triangle formed by R'G'B').

Childs teaches that overlapping triangles can be used to avoid noise and that it is possible to calculate an analysis for a triangle that uses two real primaries and one synthetic primary, made by mixing two others (pg. 8 last three paragraphs and pg. 9 first paragraph). Yanagawa teaches the importance of white point, which is included in the triangle R'G'B', so that when R'G'B' is shifted to the said white point, it produces a narrow gamut of reproducible colors (col. 6 lines 1-12). Therefore, a person of ordinary skill has good reason to pursue the option of forming more overlapping triangles as taught by Childs by using the white point by shifting those colors. If this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and

common sense. Therefore, it would have been obvious to one of ordinary skill in art at the time of present invention to try and pursue the known option forming more overlapping triangles using the white point, with a reasonable expectation of success.

24. Regarding claim 2, Childs teaches N is 3 (pg. 12 paragraph 4; Rs, Gs and Bs corresponds to three primary color points of source color space where N is 3).

25. Regarding claim 3, Childs teaches interior color point is the white point of the target color space (Fig. 5, pg. 7 lines 1-2; Fig. 5 shows that D65 is the interior point of the target color space; balance point or white point is same as illuminant D65 point).

26. Regarding claim 5, Childs teaches regions are substantially triangles (Fig. 5, pg. 8 paragraph 4; triads/triangles formed by sets of three of the display primaries corresponds to regions are substantially triangles).

27. Regarding claim 6, Childs teaches calculating a matrix that converts between an intermediate color space and the target color space for each said region bounded by at least two primaries and said interior color point (pg. 9, pg. 10 1st paragraph; XYZ corresponds to intermediate color space; real display primaries/display primaries/P1P2P3 corresponds to destination color space with at least three primaries; take sets of three display primaries corresponds to each region bounded by at least three primaries; equations 3e and 3f shows to calculate a matrix that converts between an intermediate color space XYZ and the destination color space P1P2P3). Please refer to claim 1 regarding the rejection of region bounded by said least two primaries and said interior color point.

28. Regarding claim 7, Childs teaches the intermediate color space is CIE XYZ space (pg. 4 equation 1a, paragraph 2^{nd} from last; X Y and Z are tristimulus values ... CIE 1931 colour space corresponds to intermediate color space is CIE XYZ space).

29. Regarding claim 8, Childs teaches the intermediate color space is the source color space (pg. 10 equation 3g, paragraph 2; tristimulus values of Rs Gs and Bs corresponds to intermediate color space; Rs Gs and Bs corresponds to source color space).

30. Regarding claim 9, Childs teaches the step of selecting one of said solution matrices for rendering said source color point with said target primaries comprises determining in which region said source color point resides (Fig. 3, Fig. 5, pg. 10 1^{st} paragraph, pg. 12 4^{th} paragraph; a logic unit ... selects a set for which each pixel has only positive output signals correspond to determining which said region the color point lies in; if the triad of primaries ... display matrix is negative corresponds to point does not reside in that region).

31. Regarding claim 11, Childs teaches an image processing system for converting source color points in source image data from a source color space to a target color space, said source color space defined by a combination of N primary color points, wherein N is an integer, said image processing system comprising a display panel configured to display image data in said target color space and processing circuitry (Fig. 4, pg. 12 4^{th} paragraph; Fig. 4 shows the display device displaying image in target color space of four primaries; decoding circuit corresponds to processing circuitry). Please refer to the statements presented for the rejection of claim 1 for further arguments.

32. Regarding claim 12, the statements presented above, with respect to claims 2 and 11 are incorporated herein.

33. Regarding claim 13, the statements presented above, with respect to claims 3 and 11 are incorporated herein.

34. Regarding claim 15, the statements presented above, with respect to claims 5 and 11 are incorporated herein.

35. Regarding claim 16, the statements presented above, with respect to claims 6 and 11 are incorporated herein.

36. Regarding claim 17, the statements presented above, with respect to claims 7 and 11 are incorporated herein.

37. Regarding claim 18, the statements presented above, with respect to claims 8 and 11 are incorporated herein.

38. Regarding claim 19, the statements presented above, with respect to claims 9 and 11 are incorporated herein.

39. Claims 10 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Childs and Yanagawa, and further in view of Ito (US 4,989,079).

40. Regarding claim 10, Childs teaches all of the claimed limitations as stated above, except he does not explicitly teach to determine the hue angle of said source color point and using hue angle to select the region in which said source color point resides. However, Yanagawa teaches to shift (shift is a form of transformation) R', G' and B' points in the gamut of reproducible colors. The colors in any of triangles R'G'W', R'B'W' and B'G'W' will also shift due to this transformation, changing the hue of those colors to

avoid any discontinuities (Fig. 2, col. 5 lines 53-67, col. 6 lines 1-12). Therefore, it would have been obvious to one of ordinary skill in the art at the time of present invention to shift the colors in the gamut of reproducible colors as taught by Yanagawa and use it into the system of Childs because the degree of shifting the primary colors towards the white displayed in maximum brightness at a viewing angle can be a measure for determining an area of uniform color in the color liquid crystal display device (col. 5 lines 53-67 and col. 6 lines 1-15).

Although, the combination of Childs and Yanagawa teach the claimed limitations as stated above, they do not explicitly teach to determine the hue angle of said source color point and using hue angle to select the region in which said source color point resides, and use the hue to determine the color correction parameters to avoid discontinuities due to transformation. However, Ito teaches to calculate the hue (hue angle) of a signal (source color point) on the basis of the density of ratio of three primaries, and based on the hue of the input signal (source color point) it is determined which of the six hue areas (regions) it belongs to (fig. 12, col. 16 lines 35-67, col. 17 lines 1-42). Ito further teaches to determine hue of RGB input colors for providing the color correction parameters (col. 4 line 1-26; the RGB colors of fig. 12 are analogous to the R'G'B' colors of Yanagawa's fig. 2). Therefore, it would have been obvious to one of ordinary skill in the art at the time of present invention to calculate hue of a color point to determine it's region of location as taught by Ito and apply it into the method of Childs and Yanagawa because calculating the hue on the basis of ratio of spectral densities improves color harmony at the boundary between hue areas (col. 16 lines 38-41).

41. Regarding claim 20, the statements presented above, with respect to claims 10 and 11 are incorporated herein.

42. Claims 4 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Childs and Yanagawa, and further in view of Herbert et al. (US 2004/0111435; hereinafter referred to as Herbert).

43. Regarding claim 4, Childs teaches interior color point is the white point of the target color space (Fig. 5, pg. 7 lines 1-2; Fig. 5 shows that D65 is the interior point of the target color space; balance point or white point is same as illuminant D65 point).

Although the combination of Childs and Yanagawa disclose all of the claimed limitations as stated above, except that they do not explicitly teach that the interior point is an off-white point. However, Herbert teaches to use an off white point of a lamp's light as the whitest white point of that illuminant ([0025] lines 1-11). Therefore, it would have been obvious to one of ordinary skill in the art at the time of present invention to use an off white point as the white point as taught by Herbert into the system of Childs and Yanagawa because off white points of different illuminants serves as that illuminants white point by adjusting to that illuminant's surrounding environment ([0025] lines 5-11).

44. Regarding claim 14, the statements presented above, with respect to claims 4 and 11 are incorporated herein.

45. Claim 21 and 30-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Childs, in view of Kasson, and further in view of Ito.

46. Regarding claim 21, Childs teaches a system for converting source image data color points from a source color space to a target color space, wherein said source color space is defined by N source primary color points and said target color space is defined by at least at least N+1 target primary color points (pg. 12 4th paragraph), said system comprising input means for accepting source image data color points (pg. 12 4th paragraph; transmission system corresponds to input means); a multi-primary converter for image data values from N-primary source color space into image data values for rendering in the at least N+1 primary color space configured for converting said source image data color points from the N-primary source color space into image data values for the at least N+1 primary target color space using one of a plurality of conversion matrices (Fig. 4, pg. 12 4th paragraph; decoding circuit corresponds to multi-primary converter; three primary transmission system corresponds to source image data color points from the N-primary source color space; four primary display device corresponds to image data values for the at least N+1 primary target color space; matrix outputs corresponds to plurality of conversion matrices; matrix outputs are controlled by logic unit of the decoding circuit corresponds to multi-primary converter is further configured to select said conversion matrix). Childs further teaches to select the conversion matrix by determining in which region said source color point resides (Fig. 3, Fig. 5, pg. 10 1st paragraph, pg. 12 4th paragraph; a logic unit ... selects a set for which each pixel has only positive output signals correspond to determining which said region the color point lies in; if the triad of primaries ... display matrix is negative corresponds to point does not reside in that region).

Although Childs discloses all of the claimed limitations as stated above, he does not explicitly teach a hue calculator configured for calculating hue angles for the source image data color points, and a gamut converter configured for optionally fitting the gamut of the source color space to the gamut of said target color space using the calculated hue angles. However, Kasson teaches to compute the hue angle as the arctangent of the ratio of the two chrominance components (Fig. 5, col. 8 lines 58-68), and a gamut converter for optionally fitting (mapping) the gamut of the source color space (out-gamut points) to said target color space (device-dependent gamut) using the calculated hue angles (Fig. 5, col. 8 lines 32-37 and lines 58-68, col. 9 lines 48-65; Fig. 5 shows that the computed hue angles are used to while mapping from out-gamut points to the device-dependent gamut; Kasson teaches to use the hue angles for fitting the gamut of source color space to the target color space, although he does not teach to use the hue angles optionally, but if the hue angles were used optionally then the gamut converter would be fitting the source color space to the target color space with no difference between them, and there would have been no point of converter the source color space into a target color space if it were to remain the same. It would have been obvious to one of ordinary skill in the art at the time of present invention to use hue angles if they intended to change the source space to a target color space, different than the source color space). Therefore, it would have been obvious to one of ordinary skill in the art at the time of present invention to calculate and use hue angles for gamut mapping as taught by Kasson and apply it into the method of Childs because using hue

angles helps luminance variations at low spatial frequencies to which humans are relatively insensitive (col. 8 lines 52-56).

Although the combination of Childs and Kasson teach the claimed limitations as stated above, they do not explicitly teach using the calculated hue angles of the source color point to determine the region in which the source color point resides. However, Ito teaches to calculate the hue (hue angle) of a signal (source color point) on the basis of the density of ratio of three primaries, and based on the hue of the input signal (source color point) it is determined which of the six hue areas (regions) it belongs to (fig. 12, col. 16 lines 35-67, col. 17 lines 1-42; thus Ito teaches to determine the region of the point based on the hue; it should be noted here that Childs as stated teaches to select the conversion matrix by determining in which region said source color point resides using the multi-primary converter (Fig. 3, Fig. 5, pg. 10 1st paragraph, pg. 12 4th paragraph; a logic unit ... selects a set for which each pixel has only positive output signals correspond to determining which said region the color point lies in; if the triad of primaries ... display matrix is negative corresponds to point does not reside in that region)). Therefore, it would have been obvious to one of ordinary skill in the art at the time of present invention to calculate hue of a color point to determine it's region of location as taught by Ito and apply it into the method of Childs and Kasson because calculating the hue on the basis of ratio of spectral densities improves color harmony at the boundary between hue areas (col. 16 lines 38-41).

47. Regarding claim 30, Childs teaches that the multi-primary converter comprises a multiplier configured for multiplying a source image data color point by said conversion

matrix to produce an image data value in the at least N+1 primary target color space (Fig. 4, pg. 11 equation 3j, pg. 12 fourth paragraph; matrix arithmetic units correspond to multiplier; display primary drive signals correspond to source image data color point; equation 3j on pg. 11 shows that the image data in four primary target color space (P1-P4) is produced by multiplying the conversion matrix with the display primary drive signals).

48. Regarding claim 31, Childs (figs. 4-5, pg. 12 fourth paragraph) teaches that each conversion matrix (fig. 4 shows three parallel matrix arithmetic units 12, 14 and 16) converts a source image data color point from said source color space (Rs, Gs, and Bs signals) comprising N primary color points (three primary colors) to an image data value positioned in a region (triads/triangle as shown in fig. 5) in the at least N+1 primary target color space (four display primary drive signals forms the target color space), said region being bounded by at least two of the at least N+1 primary color points of said target color space (the triads of fig. 5 are bounded by at least two of the at least N+1 primary color points).

Although, the combination of Childs and Kasson teach the claimed limitations as stated above, they do not explicitly teach to identify the region of the target image data value by one of said calculated hue angles. However, Ito teaches to calculate the hue (hue angle) of a signal (source color point) on the basis of the density of ratio of three primaries, and based on the hue of the input signal (source color point) it is determined which of the six hue areas (regions) it belongs to (fig. 12, col. 16 lines 35-67, col. 17 lines 1-42). Ito further teaches to determine hue of RGB input colors for providing the

color correction parameters (col. 4 line 1-26; the RGB colors of fig. 12 are analogous to the R'G'B' colors of Yanagawa's fig. 2). Therefore, it would have been obvious to one of ordinary skill in the art at the time of present invention to calculate hue of a color point to determine it's region of location as taught by Ito and apply it into the method of Childs and Kasson because calculating the hue on the basis of ratio of spectral densities improves color harmony at the boundary between hue areas (col. 16 lines 38-41).

49. Regarding claim 32, Childs (Figs. 3-5, pg. 12 fourth paragraph) teaches an image processing system for converting an input N-valued color image data in a source color space (Figs. 3-5, pg. 12 fourth paragraph; three system primary signals Rs, Gs and Bs) to an N+1-valued color image data in a target color space (four display primary signals), said source color space being defined by N primary color points and said target color space being defined by at least N+1 primary color points in said target color space, wherein N is an integer, said image processing system comprising a display (fig. 4) for displaying image data in said target color space defined by said at least N+1 primary color points; and processing circuitry to configured for accepting said input N-valued color image data value,. and configured for producing said N+1-valued color image data in said target color space for rendering on display (Fig. 4, pg. 12 4th paragraph; decoding circuit corresponds to processing circuitry Fig. 4 shows the display device displaying image in target color space of four primaries; Fig. 4 also shows that three primary colors Rs, Gs and Bs are accepted by the processing circuitry).

Childs further teaches to select the conversion data (conversion matrix) by determining in which region said source color point resides (it should be noted that Child

determines the conversion data based on the region of location of the point and not it's hue angle) (Fig. 3, Fig. 5, pg. 10 1st paragraph, pg. 12 4th paragraph; a logic unit ... selects a set for which each pixel has only positive output signals correspond to determining which said region the color point lies in; if the triad of primaries ... display matrix is negative corresponds to point does not reside in that region).

Although Childs discloses all of the claimed limitations as stated above, he does not explicitly teach calculating hue angles for said N-valued color image data value. However, Kasson teaches to compute the hue angle as the arctangent of the ratio of the two chrominance components (Fig. 5, col. 8 lines 58-68), and a gamut converter for optionally fitting (mapping) the gamut of the source color space (out-gamut points) to said target color space (device-dependent gamut) using the calculated hue angles (Fig. 5, col. 8 lines 32-37 and lines 58-68, col. 9 lines 48-65; Fig. 5 shows that the computed hue angles are used to while mapping from out-gamut points to the device-dependent gamut). Therefore, it would have been obvious to one of ordinary skill in the art at the time of present invention to calculate and use hue angles for gamut mapping as taught by Kasson and apply it into the method of Childs because using hue angles helps luminance variations at low spatial frequencies to which humans are relatively insensitive (col. 8 lines 52-56).

Although the combination of Childs and Kasson teach the claimed limitations as stated above, they do not explicitly teach using the calculated hue angles of the source color point to determine the region in which the source color point resides. However, Ito teaches to calculate the hue (hue angle) of a signal (source color point) on the basis of

the density of ratio of three primaries, and based on the hue of the input signal (source color point) it is determined which of the six hue areas (regions) it belongs to (fig. 12, col. 16 lines 35-67, col. 17 lines 1-42; thus Ito teaches to determine the region of the point based on the hue; it should be noted here that Childs as stated teaches to select the conversion matrix by determining in which region said source color point resides using the multi-primary converter (Fig. 3, Fig. 5, pg. 10 1st paragraph, pg. 12 4th paragraph; a logic unit ... selects a set for which each pixel has only positive output signals correspond to determining which said region the color point lies in; if the triad of primaries ... display matrix is negative corresponds to point does not reside in that region)). Therefore, it would have been obvious to one of ordinary skill in the art at the time of present invention to calculate hue of a color point to determine it's region of location as taught by Ito and apply it into the method of Childs and Kasson because calculating the hue on the basis of ratio of spectral densities improves color harmony at the boundary between hue areas (col. 16 lines 38-41).

50. Regarding claim 33, Childs teaches that the conversion data is arranged in a plurality of solution matrices (fig. 4, pg. 12 fourth paragraph; matrix arithmetic units convert the system primaries Rs, Gs and Bs into the four display primary drive signals; thus the conversion data is arranged in these matrix arithmetic units that act as solution matrices in this conversion process; since the solution matrices have conversion data, they could also be called conversion matrices). Please see the rejection of claim 21 regarding the rationale for rejecting the limitation "using said hue angle to select a solution matrix from among said plurality of solution matrices".

References Cited

51. The following references, related to the field of invention, are recorded as prior art, but not relied upon for rejection.

- Sugiura et al. (US 2005/0185840 A1)

52. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jwalant Amin whose telephone number is 571-272-2455. The examiner can normally be reached on 9:30 a.m. - 6:00 p.m..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Zimmerman can be reached on 571-272-7653. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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